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## ABSTRACT

This curriculum guide for outboard marine engine mechanics was developed by the state of Mississippi to standardize vocational education course titles and core contents. The objectives contained in this document are common to all outboard marine engine mechanics programs in the state. The guide contains objectives for outboard marine engine mechanics I and II courses. Units in course I cover the following topics: safety and orientation; tools and equipment; fasteners; measuring; engine identification and inspection; basic engine principles and design; principles of operation--four-stroke cycle; principles of operation--two-stroke cycle; cooling systems; fuel systems; and carburetion. Units in course II cover safety and orientation review; mechanical remote control assembly; tilt assembly; propeller and trim; cooling system; mechanical gearcase; advanced fuel systems; advanced carburetion; ignition systems; engine overhaul; and troubleshooting. Each unit consists of these components: objectives, with core/essential objectives indicated; suggested instructional practices; list of suggested resources; list of evaluation and suggested minimum performance standards, with core/essential objectives indicated; and performance record, with core/essential objectives indicated. A checklist for each course combining all unit performance standards into a single list is included. (KC)

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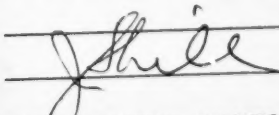
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STANDARDIZED CURRICULUM  
FOR  
OUTBOARD MARINE ENGINE MECHANICS

MISSISSIPPI DEPARTMENT OF EDUCATION  
OFFICE OF VOCATIONAL, TECHNICAL  
AND ADULT EDUCATION

June 1989

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## FOREWORD

This volume is intended to be used in the State of Mississippi as a mechanism for standardizing vocational education course titles and core contents. The need for standardization of curricula was triggered by provisions in the Educational Reform Act of 1982 which mandated:

- elimination of nearly all currently existing curriculum requirements and development of new curriculum content that is "properly sequenced" and "coordinated";
- steps to ensure that students master one level of course work before being advanced to the next level and that progression is properly sequenced;
- a criterion-referenced, state-wide testing program that is built upon an identified set of "basic skills" keyed to student performance in grades 3, 5, 8, and 11;
- revised graduation requirements that take into account student performance on the basic skills and also on a test of "functional literacy skills"; and
- a system of accrediting schools that takes into account the performance of districts, schools, and students.

In addition to the mandates of the Educational Reform Act, the Strategic Plan for Vocational and Technical Education in Mississippi also calls for improving the quality of vocational and technical education through the standardization of curricula and the articulation of secondary and postsecondary programs.

Both of these mandates were further reinforced by legislation passed in 1986 which called for the establishment of state-wide "guidelines and procedures for managing an instructional program in the public schools." This legislation calls for instructional management plans containing the following components:

1. a written list of learning objectives for every course for which academic credit is given on students' transcripts (state specified core objectives must be included);
2. suggested instructional practices and resources for the learning objectives;
3. standards for student performance for each learning objective; and
4. systematic procedures for evaluating student performance on the learning objectives.

Specific local district actions regarding the state-wide instructional management plan are also required, namely:

1. The objectives contained in this document are common to all programs in the state. Core objectives are designated with an asterisk. The local district is encouraged to add additional objectives to this listing to meet local needs of students and employers.
2. The local school board must officially adopt the learning objectives as the district's curricula.
3. Pass/fail policies must be based on mastery of learning objectives.
4. Student performance on the learning objectives must be systematically evaluated at least once during the school year.
5. During the school year, records of individual student performance must indicate whether or not the objectives have been mastered. The record must indicate mastery status for each of the objectives tested in the Basic Skills Assessment Program (including functional literacy skills) and must be permanently maintained on all students who do not master the basic and functional literacy skills prior to being tested on them.
6. Each year, information about student performance on learning objectives must be reviewed. Those objectives which students are not mastering must be identified, and a plan must be developed for improving student performance on those objectives.

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# OUTBOARD MARINE ENGINE MECHANICS I

Developed by

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## OUTBOARD MARINE ENGINE MECHANICS I

| <u>Unit No.</u> | <u>Title</u>                                |
|-----------------|---------------------------------------------|
| 1               | Safety and Orientation                      |
| 2               | Tools and Equipment                         |
| 3               | Fasteners                                   |
| 4               | Measuring                                   |
| 5               | Engine Identification and Inspection        |
| 6               | Basic Engine Principles and Design          |
| 7               | Principles of Operation - Four-Stroke Cycle |
| 8               | Principles of Operation - Two-Stroke Cycle  |
| 9               | Cooling Systems                             |
| 10              | Fuel Systems                                |
| 11              | Carburetion                                 |

COURSE: Outboard Marine Engine Mechanics I

Unit 1: Safety and Orientation

Objectives: Upon completion of this unit, the student will:

1. Match terms associated with safety.
- \*2. Match the colors of the safety code with their correct applications.
3. Complete a list of steps for maintaining a safe and orderly shop.
- \*4. Match the classes of fires with their correct descriptions.
- \*5. Distinguish between safe and unsafe shop practices.
- \*6. List general shop safety rules.
- \*7. Define terms associated with hazardous materials.
- \*8. Identify categories of hazardous materials.
- \*9. State signal words or symbols that indicate how severe a hazard may be.
- \*10. List methods for reducing hazardous waste.
- \*11. Identify general procedures for storing hazardous materials and wastes.
- \*12. Identify and describe the informational sections found on a Material Safety Data Sheet.
- \*13. Describe general first aid procedures to follow in case of an accident involving hazardous materials.
- \*14. Identify safety equipment to be used with hazardous materials.
- \*15. List steps to follow in handling spills and waste disposal.
- \*16. Identify agencies to be contacted in case of an accident or for more information on hazardous materials.
- \*17. List safety measures to take in working on boats with bilges.

\*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture and discussion

Suggested Resources:

Primary Resource: Hires, Bill; Taylor, Mark; and Bundy, Mike. Small Engine Repair: Two-Stroke and Four-Stroke Cycle. Stillwater, OK: Mid-America Vocational Curriculum Consortium. Revised by Ammon Herd. 1985. (Objectives 1-6)

Warzecha, Mary. Hazardous Materials Fingertip Retrieval System. Alexandria, VA: American Vocational Association. 1988. (Objectives 7-16)

#### Evaluation and Suggested Minimum Performance Standards:

- Objective 1: The student will match seven terms associated with shop safety.
- \*Objective 2: The student will match five colors of the safety color code with their correct applications.
- Objective 3: The student will complete a listing of seven steps for maintaining a clean and orderly shop.
- \*Objective 4: The student will match three classes of fires with their correct descriptions.
- \*Objective 5: The student will classify 30 statements concerning shop practices as being safe or unsafe with 100 percent accuracy.
- \*Objective 6: The student will list three general rules related to shop safety.
- \*Objective 7: The student will define the following terms associated with hazardous materials: hazardous material, combustible, flammable, corrosive, reactive, E P toxic.
- \*Objective 8: The student will identify five categories of hazardous materials.
- \*Objective 9: The student will state in order the five signal words or symbols that indicate how severe a hazard may be.
- \*Objective 10: The student will list seven methods for reducing hazardous waste.
- \*Objective 11: The student will identify general procedures for storing hazardous materials and wastes including the following: (a) Make sure that all containers are properly labeled at all times, (b) Mark all containers containing hazardous waste materials with the words "HAZARDOUS WASTE" and with the date that the container was first used to store the waste, (c) Store wastes and materials as described by the manufacturer, (d) Make sure that containers are intact and secure at all times, and (e) Keep all containers closed securely except when being filled or emptied.
- \*Objective 12: The student will identify and describe nine sections of information found on a Material Safety Data Sheet which provide guidelines for creating a safe work environment.
- \*Objective 13: The student will describe the following first aid procedures to be followed in case of an accident involving hazardous materials: (a) Move the victim to fresh air, (b) Check the container label, Material Safety Data Sheet, or other source for first aid procedures and begin first aid at once, (c) Contact the person designated to help with first aid and evacuation procedures, (d) Call an ambulance, (e) Follow instructions from the designated person concerning further first aid and evacuation measures,

(f) Remain with the person until the ambulance arrives, and (g) Attach a Material Safety Data Sheet or other information on the material to the person's clothing prior to transport.

- \*Objective 14: The student will identify seven different pieces of equipment which can be used to protect the body when working with hazardous materials.
- \*Objective 15: The student will list seven general steps to follow in handling spills and waste disposal.
- \*Objective 16: The student will identify three Federal and one State agency which should be contacted in case of an accident or to obtain more information about hazardous materials.
- \*Objective 17: The student will list two safety measures to follow in working on boats with bilges.

\*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

- \_\_\_ 1. Matched terms associated with safety.
- \_\_\_ \*2. Matched the colors of the safety code with their correct applications.
- \_\_\_ 3. Completed a list of steps for maintaining a safe and orderly shop.
- \_\_\_ \*4. Matched the classes of fires with their correct descriptions.
- \_\_\_ \*5. Distinguished between safe and unsafe shop practices.
- \_\_\_ \*6. Listed general shop safety rules.
- \_\_\_ \*7. Defined terms associated with hazardous materials.
- \_\_\_ \*8. Identified categories of hazardous materials.
- \_\_\_ \*9. Stated signal words or symbols that indicate how severe a hazard may be.
- \_\_\_ \*10. Listed methods for reducing hazardous waste.
- \_\_\_ \*11. Identified general procedures for storing hazardous materials and wastes.
- \_\_\_ \*12. Identified and described the informational sections found on a Material Safety Data Sheet.
- \_\_\_ \*13. Described general first aid procedures to follow in case of an accident involving hazardous materials.
- \_\_\_ \*14. Identified safety equipment to be used with hazardous materials.
- \_\_\_ \*15. Listed steps to follow in handling spills and waste disposal.
- \_\_\_ \*16. Identified agencies to be contacted in case of an accident or for more information on hazardous materials.
- \_\_\_ \*17. Listed safety measures to follow in working on boats with bilges.

\*Indicates core/essential objectives

COURSE: Outboard Marine Engine Mechanics I

Unit 2: Tools and Equipment

Objectives: Upon completion of this unit, the student will:

- \*1. Identify basic hand tools needed for maintenance and repair of small engines.
- \*2. Identify the types of torque wrenches.
- 3. Complete a list of statements concerning the maintenance procedures of hand tools.

\*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture and discussion  
Laboratory demonstration and practice

Suggested Resources:

Primary Resource: Hires, Bill; Taylor, Mark; and Bundy, Mike.  
Small Engine Repair: Two-Stroke and Four-Stroke Cycle. Stillwater, OK: Mid-America Vocational Curriculum Consortium. Revised by Ammon Herd. 1985.

Evaluation and Suggested Minimum Performance Standards:

- \*Objective 1: The student will identify 20 basic hand tools used in small engine repair and maintenance.
- \*Objective 2: The student will identify two different types of torque wrenches.
- Objective 3: The student will complete a listing of five statements concerning the maintenance of hand tools.

\*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

- \_\_\_ \*1. Identified basic hand tools needed for maintenance and repair of small engines.
- \_\_\_ \*2. Identified the types of torque wrenches.
- \_\_\_ 3. Completed a list of statements concerning the maintenance procedures of hand tools.

\*Indicates core/essential objectives

COURSE: Outboard Marine Engine Mechanics I

Unit 3: Fasteners

Objectives: Upon completion of this unit, the student will:

1. Identify common fasteners.
- \*2. List methods used to remove seized nuts.
3. Identify tools used to restore internal and external threads.

\*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture and discussion  
Laboratory demonstration and practice

Suggested Resources:

Primary Resource: Hires, Bill; Taylor, Mark; and Bundy, Mike.  
Small Engine Repair: Two-Stroke and Four-Stroke Cycle. Stillwater, OK: Mid-America Vocational Curriculum Consortium. Revised by Ammon Herd. 1985.

Evaluation and Suggested Minimum Performance Standards:

- Objective 1: The student will identify 15 common fastening devices used on small engines.
- \*Objective 2: The student will list four methods for removing a seized nut.
- Objective 3: The student will identify four tools used to restore internal and external threads.

\*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

- \_\_\_ 1. Identified common fasteners.
- \_\_\_ \*2. Listed methods used to remove seized nuts.
- \_\_\_ 3. Identified tools used to restore internal and external threads.

\*Indicates core/essential objectives

COURSE: Outboard Marine Engine Mechanics I

Unit 4: Measuring

Objectives: Upon completion of this unit, the student will:

- \*1. Identify measuring instruments used in small engine repair.
- \*2. Use a plain micrometer.
- \*3. Use a vernier caliper.

\*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture and discussion  
Laboratory demonstration and practice

Suggested Resources:

Primary Resource: Hires, Bill; Taylor, Mark; and Bundy, Mike.  
Small Engine Repair: Two-Stroke and Four-Stroke Cycle. Stillwater, OK: Mid-America Vocational Curriculum Consortium. Revised by Ammon Herd. 1985.

Evaluation and Suggested Minimum Performance Standards:

- \*Objective 1: The student will identify the following measuring instruments: inside micrometer and outside micrometer.
- \*Objective 2: The student will use a plain micrometer to measure a given object to within +/- .001 inch.
- \*Objective 3: The student will use a vernier caliper to measure a given object to within +/- .001 inch.

\*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

- \_\_\_ \*1. Identified measuring instruments used in small engine repair.
- \_\_\_ \*2. Used a plain micrometer.
- \_\_\_ \*3. Used a vernier caliper.

\*Indicates core/essential objectives

COURSE: Outboard Marine Engine Mechanics I

Unit 5: Engine Identification and Inspection

Objectives: Upon completion of this unit, the student will:

- \*1. Match terms associated with engine identification and inspection.
- \*2. Distinguish characteristics of four-stroke and two-stroke cycle engines.
- \*3. Identify the operating positions of the crankshaft.

\*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture and discussion  
Laboratory demonstration and practice

Suggested Resources:

Primary Resource: Hires, Bill; Taylor, Mark; and Bundy, Mike.  
Small Engine Repair: Two-Stroke and Four-Stroke Cycle. Stillwater, OK: Mid-America Vocational Curriculum Consortium. Revised by Ammon Herd. 1985.

Evaluation and Suggested Minimum Performance Standards:

- \*Objective 1: The student will match five terms associated with engine identification and inspection to their definitions.
- \*Objective 2: The student will distinguish three characteristics of four-stroke and two-stroke cycle engines.
- \*Objective 3: The student will identify the three operating positions of a crankshaft.

\*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

- \_\_\_ \*1. Matched terms associated with engine identification and inspection.
- \_\_\_ \*2. Distinguished characteristics of four-stroke and two-stroke cycle engines.
- \_\_\_ \*3. Identified the operating positions of the crankshaft.

\*Indicates core/essential objectives

COURSE: Outboard Marine Engine Mechanics I

Unit 6: Basic Engine Principles and Design

Objectives: Upon completion of this unit, the student will:

- \*1. Match terms associated with basic engine principles and design.
- \*2. Match the parts of a basic internal combustion engine cylinder unit with their correct descriptions.
3. Complete a list of statements in the process by which an internal combustion engine converts chemical energy into rotary motion.

\*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture and discussion  
Laboratory demonstration and practice

Suggested Resources:

Primary Resource: Hires, Bill; Taylor, Mark; and Bundy, Mike.  
Small Engine Repair: Two-Stroke and Four-Stroke Cycle. Stillwater, OK: Mid-America Vocational Curriculum Consortium. Revised by Ammon Herd. 1985.

Evaluation and Suggested Minimum Performance Standards:

- \*Objective 1: The student will match 15 terms associated with basic engine principles and design to their proper definitions.
- \*Objective 2: The student will match five parts of a basic internal combustion engine cylinder unit to their proper descriptions.
- Objective 3: The student will complete a listing of four steps in the process by which an internal combustion engine converts chemical energy into rotary motion.

\*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

- \_\_\_ \*1. Matched terms associated with basic engine principles and design.
- \_\_\_ \*2. Matched the parts of a basic internal combustion engine cylinder unit with their correct descriptions.

- 3. Completed a list of statements in the process by which an internal combustion engine converts chemical energy into rotary motion.

\*Indicates core/essential objectives

COURSE: Outboard Marine Engine Mechanics I

Unit 7: Principles of Operation - Four-Stroke Cycle

Objectives: Upon completion of this unit, the student will:

- \*1. Match terms associated with the principles of operation of a four-stroke cycle engine.
- \*2. Identify basic components of a four-stroke cycle engine.
- 3. Select true statements concerning the operation of a four-stroke cycle engine.

\*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture and discussion

Suggested Resources:

Primary Resource: Hires, Bill; Taylor, Mark; and Bundy, Mike.  
Small Engine Repair: Two-Stroke and Four-Stroke Cycle. Stillwater, OK: Mid-merica Vocational Curriculum Consortium. Revised by Ammon Herd. 1985.

Evaluation and Suggested Minimum Performance Standards:

- \*Objective 1: The student will match ten terms associated with the principles of operation of a four-stroke cycle engine to their proper definitions.
- \*Objective 2: The student will identify seven basic components of a four-stroke cycle engine.
- Objective 3: The student will distinguish seven statements as being true or false concerning the operation of a four-stroke cycle engine as related to each stroke of the cycle.

\*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

- \_\_\_ \*1. Matched terms associated with the principles of operation of a four-stroke cycle engine.
- \_\_\_ \*2. Identified basic components of a four-stroke cycle engine.
- \_\_\_ 3. Selected true statements concerning the operation of a four-stroke cycle engine.

\*Indicates core/essential objectives

COURSE: Outboard Marine Engine Mechanics I

Unit 8: Principles of Operation - Two-Stroke Cycle

Objectives: Upon completion of this unit, the student will:

- \*1. Match terms associated with the two-stroke cycle engine.
- \*2. Identify basic components of a two-stroke cycle engine.
- 3. Select true statements concerning the operation of a two-stroke cycle engine.

\*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture and discussion  
Laboratory demonstration and practice

Suggested Resources:

Primary Resource: Hires, Bill; Taylor, Mark; and Bundy, Mike.  
Small Engine Repair: Two-Stroke and Four-Stroke Cycle. Stillwater, OK: Mid-America Vocational Curriculum Consortium. Revised by Ammon Herd. 1985.

Evaluation and Suggested Minimum Performance Standards:

- \*Objective 1: The student will match five terms associated with the two-stroke cycle engine to their proper definitions.
- \*Objective 2: The student will identify six basic components of a two-stroke cycle engine.
- Objective 3: The student will distinguish five statements as being true or false concerning the operation of a two-stroke cycle engine.

\*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

- \_\_\_ \*1. Matched terms associated with the two-stroke cycle engine.
- \_\_\_ \*2. Identified basic components of a two-stroke cycle engine.
- \_\_\_ 3. Selected true statements concerning the operation of a two-stroke cycle engine.

\*Indicates core/essential objectives

COURSE: Outboard Marine Engine Mechanics I

Unit 9: Cooling Systems

Objectives: Upon completion of this unit, the student will:

- \*1. Match terms associated with air-cooled cooling systems.
- \*2. Identify components of an air cooled engine cooling system.
- \*3. Remove, clean, and replace air cooling system parts.
- \*4. Identify the parts of a water-cooled engine cooling system.
- \*5. Inspect and service a water-cooled engine cooling system.

\*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture and discussion  
Laboratory demonstration and practice

Suggested Resources:

Primary Resource: Hires, Bill; Taylor, Mark; and Bundy, Mike.  
Small Engine Repair: Two-Stroke and Four-Stroke Cycle. Stillwater, OK: Mid-America Vocational Curriculum Consortium. Revised by Ammon Herd. 1985.

Evaluation and Suggested Minimum Performance Standards:

- \*Objective 1: The student will match four terms associated with air-cooled cooling systems to their proper definitions.
- \*Objective 2: The student will identify four components of an air cooled engine cooling system.
- \*Objective 3: The student will remove, clean, and replace air cooling system parts following industry accepted procedures.
- \*Objective 4: The student will identify the following parts of a water-cooled engine cooling system: radiator, upper and lower radiator hose, thermostat housing, thermostat, water pump.
- \*Objective 5: The student will inspect and service a water-cooled engine cooling system by checking the radiator for leaks, checking the hoses, draining and flushing the system, checking the thermostat, checking the radiator cap, and refilling the system with antifreeze mix.

\*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

- \_\_\_ \*1. Matched terms associated with air-cooled cooling systems.
- \_\_\_ \*2. Identified components of an air cooled engine cooling system.
- \_\_\_ \*3. Removed, cleaned, and replaced air cooling system parts.
- \_\_\_ \*4. Identified the parts of a water-cooled engine cooling system.
- \_\_\_ \*5. Inspected and serviced a water-cooled engine cooling system.

\*Indicates core/essential objectives

COURSE: Outboard Marine Engine Mechanics I

Unit 10: Fuel Systems

Objectives: Upon completion of this unit, the student will:

- \*1. Match terms associated with outboard fuel systems with their proper definitions.
- \*2. Identify the parts of an outboard vacuum fuel system.
- \*3. Identify the parts of a primer bulb of an outboard vacuum fuel system.

\*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture and discussion

Suggested Resources:

Primary Resource: Hardway, Jack. Revised by Lanny Johnson.  
Outboard Repair. Stillwater, OK: Mid-America  
Vocational Curriculum Consortium. 1985.

Evaluation and Suggested Minimum Performance Standards:

- \*Objective 1: The student will match three terms associated with outboard fuel systems with their proper definitions.
- \*Objective 2: The student will identify three parts of an outboard vacuum fuel system.
- \*Objective 3: The student will identify three parts of a primer bulb of an outboard vacuum fuel system.

\*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

- \_\_\_ \*1. Matched terms associated with outboard fuel systems with their proper definitions.
- \_\_\_ \*2. Identified the parts of an outboard vacuum fuel system.
- \_\_\_ \*3. Identified the parts of a primer bulb of an outboard vacuum fuel system.

\*Indicates core/essential objectives

COURSE: Outboard Marine Engine Mechanics I

Unit 11: Carburetion

Objectives: Upon completion of this unit, the student will:

- \*1. Match terms associated with carburetion to their proper definitions.
- \*2. Identify the parts of carburetor.
- \*3. Select possible carburetor problems.

\*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture and discussion  
Laboratory demonstration and practice

Suggested Resources:

Primary Resource: Hardway, Jack. Revised by Lanny Johnson.  
Outboard Repair. Stillwater, OK: Mid-America  
Vocational Curriculum Consortium. 1985.

Evaluation and Suggested Minimum Performance Standards:

- \*Objective 1: The student will match eight terms associated with carburetion to their proper definitions.
- \*Objective 2: The student will identify seven parts of carburetor.
- \*Objective 3: The student will select five possible carburetor problems.

\*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

- \_\_\_ \*1. Matched terms associated with carburetion to their proper definitions.
- \_\_\_ \*2. Identified the parts of carburetor.
- \_\_\_ \*3. Selected possible carburetor problems.

\*Indicates core/essential objectives

## OUTBOARD MARINE ENGINE MECHANICS II

Developed by

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Team Leader

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## OUTBOARD MARINE ENGINE MECHANICS II

| <u>Unit No.</u> | <u>Title</u>                       |
|-----------------|------------------------------------|
| 1               | Safety and Orientation Review      |
| 2               | Mechanical Remote Control Assembly |
| 3               | Tilt Assembly                      |
| 4               | Propellor and Trim                 |
| 5               | Cooling System                     |
| 6               | Mechanical Gearcase                |
| 7               | Advanced Fuel Systems              |
| 8               | Advanced Carburetion               |
| 9               | Ignition Systems                   |
| 10              | Engine Overhaul                    |
| 11              | Troubleshooting                    |

COURSE: Outboard Marine Engine Mechanics II

Unit 1: Safety and Orientation (Review and Reinforcement)

Objectives: Upon completion of this unit, the student will:

1. Match terms associated with safety.
- \*2. Match the colors of the safety code with their correct applications.
3. Complete a list of steps for maintaining a safe and orderly shop.
- \*4. Match the classes of fires with their correct descriptions.
- \*5. Distinguish between safe and unsafe shop practices.
- \*6. List general shop safety rules.
- \*7. Define terms associated with hazardous materials.
- \*8. Identify categories of hazardous materials.
- \*9. State signal words or symbols that indicate how severe a hazard may be.
- \*10. List methods for reducing hazardous waste.
- \*11. Identify general procedures for storing hazardous materials and wastes.
- \*12. Identify and describe the informational sections found on a Material Safety Data Sheet.
- \*13. Describe general first aid procedures to follow in case of an accident involving hazardous materials.
- \*14. Identify safety equipment to be used with hazardous materials.
- \*15. List steps to follow in handling spills and waste disposal.
- \*16. Identify agencies to be contacted in case of an accident or for more information on hazardous materials.

\*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture and discussion

Suggested Resources:

Primary Resource: Hires, Bill; Taylor, Mark; and Bundy, Mike. Small Engine Repair: Two-Stroke and Four-Stroke Cycle. Stillwater, OK: Mid-America Vocational Curriculum Consortium. Revised by Ammon Herd. 1985. (Objectives 1-6)

Warzecha, Mary. Hazardous Materials Fingertip Retrieval System. Alexandria, VA: American Vocational Association. 1988. (Objectives 7-16)

Evaluation and Suggested Minimum Performance Standards:

- Objective 1: The student will match seven terms associated with shop safety.
- \*Objective 2: The student will match five colors of the safety color code with their correct applications.
- Objective 3: The student will complete a listing of seven steps for maintaining a clean and orderly shop.
- \*Objective 4: The student will match three classes of fires with their correct descriptions.
- \*Objective 5: The student will classify 30 statements concerning shop practices as being safe or unsafe with 100 percent accuracy.
- \*Objective 6: The student will list three general rules related to shop safety.
- \*Objective 7: The student will define the following terms associated with hazardous materials: hazardous material, combustible, flammable, corrosive, reactive, E P toxic.
- \*Objective 8: The student will identify five categories of hazardous materials.
- \*Objective 9: The student will state in order the five signal words or symbols that indicate how severe a hazard may be.
- \*Objective 10: The student will list seven methods for reducing hazardous waste.
- \*Objective 11: The student will identify general procedures for storing hazardous materials and wastes including the following: (a) Make sure that all containers are properly labeled at all times, (b) Mark all containers containing hazardous waste materials with the words "HAZARDOUS WASTE" and with the date that the container was first used to store the waste, (c) Store wastes and materials as described by the manufacturer, (d) Make sure that containers are intact and secure at all times, and (e) Keep all containers closed securely except when being filled or emptied.
- \*Objective 12: The student will identify and describe nine sections of information found on a Material Safety Data Sheet which provide guidelines for creating a safe work environment.
- \*Objective 13: The student will describe the following first aid procedures to be followed in case of an accident involving hazardous materials: (a) Move the victim to fresh air, (b) Check the container label, Material Safety Data Sheet, or other source for first aid procedures and begin first aid at once, (c) Contact the person designated to help with first aid and evacuation procedures, (d) Call an ambulance, (e) Follow instructions from the designated person concerning further first aid and evacuation measures,

(f) Remain with the person until the ambulance arrives, and (g) Attach a Material Safety Data Sheet or other information on the material to the person's clothing prior to transport.

\*Objective 14: The student will identify seven different pieces of equipment which can be used to protect the body when working with hazardous materials.

\*Objective 15: The student will list seven general steps to follow in handling spills and waste disposal.

\*Objective 16: The student will identify three Federal and one State agency which should be contacted in case of an accident or to obtain more information about hazardous materials.

\*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

- \_\_\_ 1. Matched terms associated with safety.
- \_\_\_ \*2. Matched the colors of the safety code with their correct applications.
- \_\_\_ 3. Completed a list of steps for maintaining a safe and orderly shop.
- \_\_\_ \*4. Matched the classes of fires with their correct descriptions.
- \_\_\_ \*5. Distinguished between safe and unsafe shop practices.
- \_\_\_ \*6. Listed general shop safety rules.
- \_\_\_ \*7. Defined terms associated with hazardous materials.
- \_\_\_ \*8. Identified categories of hazardous materials.
- \_\_\_ \*9. Stated signal words or symbols that indicate how severe a hazard may be.
- \_\_\_ \*10. Listed methods for reducing hazardous waste.
- \_\_\_ \*11. Identified general procedures for storing hazardous materials and wastes.
- \_\_\_ \*12. Identified and described the informational sections found on a Material Safety Data Sheet.
- \_\_\_ \*13. Described general first aid procedures to follow in case of an accident involving hazardous materials.
- \_\_\_ \*14. Identified safety equipment to be used with hazardous materials.
- \_\_\_ \*15. Listed steps to follow in handling spills and waste disposal.
- \_\_\_ \*16. Identified agencies to be contacted in case of an accident or for more information on hazardous materials.

\*Indicates core/essential objectives

COURSE: Outboard Marine Engine Mechanics II

Unit 2: Mechanical Remote Control Assembly

Objectives: Upon completion of this unit, the student will:

- \*1. Identify the main parts of the mechanical remote control assembly.
- \*2. Disassemble and reassemble a mechanical remote control assembly.
- \*3. Install and adjust shift and throttle control cables.

\*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture and discussion  
Laboratory demonstration and practice

Suggested Resources:

Primary Resource: Hardway, Jack. Revised by Lanny Johnson.  
Outboard Repair. Stillwater, OK: Mid-America  
Vocational Curriculum Consortium. 1985.

Evaluation and Suggested Minimum Performance Standards:

- \*Objective 1: The student will identify seven main parts of the mechanical remote control assembly.
- \*Objective 2: The student will disassemble and reassemble a mechanical remote control assembly following manufacturer's recommended procedures and specifications.
- \*Objective 3: The student will install and adjust shift and throttle control cables following the manufacturer's recommended procedures and specifications.

\*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

- \_\_\_ \*1. Identified the main parts of the mechanical remote control assembly.
- \_\_\_ \*2. Disassembled and reassembled a mechanical remote control assembly.
- \_\_\_ \*3. Installed and adjusted shift and throttle control cables.

\*Indicates core/essential objectives

COURSE: Outboard Marine Engine Mechanics II

Unit 3: Tilt Assembly

Objectives: Upon completion of this unit, the student will:

- \*1. Match terms related to tilt assemblies to their definitions.
- 2. Distinguish between the types of tilt assemblies.
- \*3. Distinguish between types of hydraulic assemblies.
- \*4. Identify the parts of the hydraulic tilt and trim assembly.
- \*5. Identify the parts of the manual tilt assembly.
- \*6. Service a hydraulic tilt and trim assembly.

\*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture and discussion  
Laboratory demonstration and practice

Suggested Resources:

Primary Resource: Hardway, Jack. Revised by Lanny Johnson.  
Outboard Repair. Stillwater, OK: Mid-America  
Vocational Curriculum Consortium. 1985.

Evaluation and Suggested Minimum Performance Standards:

- \*Objective 1: The student will match six terms related to tilt assemblies to their definitions.
- Objective 2: The student will distinguish between the two types of tilt assemblies.
- \*Objective 3: The student will distinguish between types of two hydraulic assemblies.
- \*Objective 4: The student will identify six parts of the hydraulic tilt and trim assembly.
- \*Objective 5: The student will identify seven parts of the manual tilt assembly.
- \*Objective 6: The student will service a hydraulic tilt and trim assembly following manufacturer's specifications and recommended procedures.

\*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

- \_\_\_ \*1. Matched terms related to tilt assemblies to their definitions.
- \_\_\_ 2. Distinguished between the types of tilt assemblies.
- \_\_\_ \*3. Distinguished between types of hydraulic assemblies.
- \_\_\_ \*4. Identified the parts of the hydraulic tilt and trim assembly.
- \_\_\_ \*5. Identified the parts of the manual tilt assembly.
- \_\_\_ \*6. Serviced a hydraulic tilt and trim assembly.

\*Indicates core/essential objectives

COURSE: Outboard Marine Engine Mechanics II

Unit 4: Propellor and Trim

Objectives: Upon completion of this unit, the student will:

- \*1. Match terms associated with propellers and trim tabs to their proper definitions.
- \*2. Identify parts of the propellor and trim tab.
- \*3. List the common types of propellers.
- 4. Select kinds of materials used to make propellers.
- \*5. Determine the correct propellor pitch for a given boat and motor.
- 6. Complete a list of statements concerning the purposes of the trim tab.
- \*7. Remove, inspect, and install a propellor.
- \*8. Remove, inspect, install, and adjust a trim tab.
- \*9. Install a slip clutch and shear pin.

\*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture and discussion  
Laboratory demonstration and practice

Suggested Resources:

Primary Resource: Hardway, Jack. Revised by Lanny Johnson.  
Outboard Repair. Stillwater, OK: Mid-America  
Vocational Curriculum Consortium. 1985.

Evaluation and Suggested Minimum Performance Standards:

- \*Objective 1: The student will match seven terms associated with propellers and trim tabs to their proper definitions.
- \*Objective 2: The student will identify five parts of the propellor and trim tab.
- \*Objective 3: The student will list the two common types of propellers.
- Objective 4: The student will select three kinds of materials used to make propellers.
- \*Objective 5: The student will determine the correct propellor pitch for a given boat and motor.
- Objective 6: The student will complete a listing of three statements concerning the purposes of the trim tab.
- \*Objective 7: The student will remove, inspect, and install a propellor according to manufacturer's specifications and recommended procedures.

\*Objective 8: The student will remove, inspect, install, and adjust a trim tab according to manufacturer's specifications and recommended procedures.

\*Objective 9: The student will install a slip clutch and shear pin to manufacturer's specifications.

\*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

- \_\_\_ \*1. Matched terms associated with propellers and trim tabs to their proper definitions.
- \_\_\_ \*2. Identified parts of the propeller and trim tab.
- \_\_\_ \*3. Listed the common types of propellers.
- \_\_\_ 4. Selected kinds of materials used to make propellers.
- \_\_\_ \*5. Determined the correct propeller pitch for a given boat and motor.
- \_\_\_ 6. Completed a list of statements concerning the purposes of the trim tab.
- \_\_\_ \*7. Removed, inspected, and installed a propeller.
- \_\_\_ \*8. Removed, inspected, installed, and adjusted a trim tab.
- \_\_\_ \*9. Installed a slip clutch and shear pin

\*Indicates core/essential objectives

COURSE: Outboard Marine Engine Mechanics II

Unit 5: Cooling System

Objectives: Upon completion of this unit, the student will:

- \*1. Match terms related to the cooling system with their correct definitions.
- \*2. Identify the parts of a cooling system.
- \*3. Identify the parts of the exhaust housing.
- 4. Select true statements concerning the functions of the wet sleeve, exhaust relief, and exhaust housing.
- \*5. Identify the parts of the water pump.
- 6. Distinguish between impeller positions.
- \*7. Select true statements concerning the operation of a thermostat.
- \*8. Complete statements concerning the operation of the cooling system.
- \*9. Complete statements concerning troubleshooting the cooling system.
- \*10. Remove, inspect, and install a water pump.
- \*11. Remove, inspect, and install a thermostat.
- \*12. Remove, inspect, and install an exhaust housing.

\*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture and discussion  
Laboratory demonstration and practice

Suggested Resources:

Primary Resource: Hardway, Jack. Revised by Lanny Johnson.  
Outboard Repair. Stillwater, OK: Mid-America  
Vocational Curriculum Consortium. 1985.

Evaluation and Suggested Minimum Performance Standards:

- \*Objective 1: The student will match nine terms related to the cooling system with their correct definitions.
- \*Objective 2: The student will identify five parts of a cooling system.
- \*Objective 3: The student will identify six parts of the exhaust housing.
- Objective 4: The student will select three true statements concerning the functions of the wet sleeve, exhaust relief, and exhaust housing.
- \*Objective 5: The student will identify five parts of the water pump.

- Objective 6: The student will distinguish between the two impeller positions.
- \*Objective 7: The student will select two true statements concerning the operation of a thermostat.
- \*Objective 8: The student will complete three statements concerning the operation of the cooling system.
- \*Objective 9: The student will complete five statements concerning troubleshooting the cooling system.
- \*Objective 10: The student will remove, inspect, and install a water pump as per manufacturer's specifications and procedures.
- \*Objective 11: The student will remove, inspect, and install a thermostat following manufacturer's procedures and specifications.
- \*Objective 12: The student will remove, inspect, and install an exhaust housing following manufacturer's specifications and procedures.

\*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

- \_\_\_ \*1. Matched terms related to the cooling system with their correct definitions.
- \_\_\_ \*2. Identified the parts of a cooling system.
- \_\_\_ \*3. Identified the parts of the exhaust housing.
- \_\_\_ 4. Selected true statements concerning the functions of the wet sleeve, exhaust relief, and exhaust housing.
- \_\_\_ \*5. Identified the parts of the water pump.
- \_\_\_ 6. Distinguished between impeller positions.
- \_\_\_ \*7. Selected true statements concerning the operation of a thermostat.
- \_\_\_ \*8. Completed statements concerning the operation of the cooling system.
- \_\_\_ \*9. Completed statements concerning troubleshooting the cooling system.
- \_\_\_ \*10. Removed, inspected, and installed a water pump.
- \_\_\_ \*11. Removed, inspected, and installed a thermostat.
- \_\_\_ \*12. Removed, inspected, and installed an exhaust housing.

\*Indicates core/essential objectives

COURSE: Outboard Marine Engine Mechanics II

Unit 6: Mechanical Gearcase

Objectives: Upon completion of this unit, the student will:

- \*1. Match terms related to the mechanical gearcase with their proper definitions.
- \*2. Identify the parts of a mechanical gearcase.
- \*3. Match the main parts of the mechanical gearcase with their purposes.
- \*4. Disassemble, reassemble, and service a one-piece mechanical gearcase.
- \*5. Disassemble, inspect, reassemble, and service a two-piece mechanical gearcase.

\*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture and discussion  
Laboratory demonstration and practice

Suggested Resources:

Primary Resource: Hardway, Jack. Revised by Lanny Johnson.  
Outboard Repair. Stillwater, OK: Mid-America  
Vocational Curriculum Consortium. 1985.

Evaluation and Suggested Minimum Performance Standards:

- \*Objective 1: The student will match five terms related to the mechanical gearcase with their proper definitions.
- \*Objective 2: The student will identify 12 parts of a mechanical gearcase.
- \*Objective 3: The student will match three main parts of the mechanical gearcase with their purposes.
- \*Objective 4: The student will disassemble, reassemble, and service a one-piece mechanical gearcase following manufacturer's specifications and procedures.
- \*Objective 5: The student will disassemble, inspect, reassemble, and service a two-piece mechanical gearcase following manufacturer's specifications and procedures.

\*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

- \_\_\_ \*1. Matched terms related to the mechanical gearcase with their proper definitions.
- \_\_\_ \*2. Identified the parts of a mechanical gearcase.
- \_\_\_ \*3. Matched the main parts of the mechanical gearcase with their purposes.
- \_\_\_ \*4. Disassembled, reassembled, and serviced a one-piece mechanical gearcase.
- \_\_\_ \*5. Disassembled, inspected, reassembled, and serviced a two-piece mechanical gearcase.

\*Indicates core/essential objectives

COURSE: Outboard Marine Engine Mechanics II

Unit 7: Advanced Fuel Systems

Objectives: Upon completion of this unit, the student will:

- \*1. List fuel system problems which can cause an outboard to perform improperly.
- \*2. Select engine problems which are caused from an improper fuel supply.
- \*3. Disassemble, service, and reassemble a vacuum fuel system.

\*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture and discussion  
Laboratory demonstration and practice

Suggested Resources:

Primary Resource: Hardway, Jack. Revised by Lanny Johnson.  
Outboard Repair. Stillwater, OK: Mid-America  
Vocational Curriculum Consortium. 1985.

Evaluation and Suggested Minimum Performance Standards:

- \*Objective 1: The student will list three fuel system problems which can cause an outboard to perform improperly.
- \*Objective 2: The student will select three engine problems which are caused from an improper fuel supply.
- \*Objective 3: The student will disassemble, service, and reassemble a vacuum fuel system following manufacturer's specifications and procedures.

\*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

- \_\_\_ \*1. Listed fuel system problems which can cause an outboard to perform improperly.
- \_\_\_ \*2. Selected engine problems which are caused from an improper fuel supply.
- \_\_\_ \*3. Disassembled, serviced, and reassembled a vacuum fuel system.

\*Indicates core/essential objectives

COURSE: Outboard Marine Engine Mechanics II

Unit 8: Advanced Carburetion

Objectives: Upon completion of this unit, the student will:

- \*1. List symptoms of poor carburetion.
- \*2. Remove, disassemble, service, reassemble, and reinstall a carburetor.

\*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture and discussion  
Laboratory demonstration and practice

Suggested Resources:

Primary Resource: Hardway, Jack. Revised by Lanny Johnson.  
Outboard Repair. Stillwater, OK: Mid-America  
Vocational Curriculum Consortium. 1985.

Evaluation and Suggested Minimum Performance Standards:

- \*Objective 1: The student will list five symptoms of poor carburetion.
- \*Objective 2: The student will remove, disassemble, service, reassemble, and reinstall a carburetor following manufacturer's specifications and procedures.

\*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

- \_\_\_ \*1. Listed symptoms of poor carburetion.
- \_\_\_ \*2. Removed, disassembled, serviced, reassembled, and reinstalled a carburetor.

\*Indicates core/essential objectives

COURSE: Outboard Marine Engine Mechanics II

Unit 9: Ignition Systems

Objectives: Upon completion of this unit, the student will:

- \*1. State the purpose of the ignition system.
2. Identify parts of a Mercury belt driven, pointless, capacitor discharge system.
- \*3. Complete a schematic diagram of a magneto ignition system.
- \*4. Complete a troubleshooting chart for the ignition system.
- \*5. Disassemble, adjust and/or repair, and reassemble a magneto ignition system.

\*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture and discussion  
Laboratory demonstration and practice

Suggested Resources:

Primary Resource: Hardway, Jack. Revised by Lanny Johnson.  
Outboard Repair. Stillwater, OK: Mid-America  
Vocational Curriculum Consortium. 1985.

Evaluation and Suggested Minimum Performance Standards:

- \*Objective 1: The student will state one purpose of the ignition system.
- Objective 2: The student will identify five parts of a Mercury belt driven, pointless, capacitor discharge system.
- \*Objective 3: The student will complete a schematic diagram of a magneto ignition system by correctly identifying five symbols.
- \*Objective 4: The student will complete a troubleshooting chart for the ignition system.
- \*Objective 5: The student will disassemble, adjust and/or repair, and reassemble a magneto ignition system following manufacturer's specifications and procedures.

\*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

- ☐ \*1. Stated the purpose of the ignition system.
- ☐ 2. Identified parts of a Mercury belt driven, pointless, capacitor discharge system.
- ☐ \*3. Completed a schematic diagram of a magneto ignition system.
- ☐ \*4. Completed a troubleshooting chart for the ignition system.
- ☐ \*5. Disassembled, adjusted and/or repaired, and reassembled a magneto ignition system.

\*Indicates core/essential objectives

COURSE: Outboard Marine Engine Mechanics II

Unit 10: Engine Overhaul

Objectives: Upon completion of this unit, the student will:

- \*1. Match terms related to the overhaul of two-stroke cycle engines with their correct definitions.
- \*2. List causes of two-stroke cycle engine problems.
- \*3. Identify the parts of the two-stroke cycle piston and connecting rod assembly.
- \*4. Identify the parts of the two-stroke cycle crankshaft assembly.
- \*5. Disassemble, inspect, service, and reassemble a two-stroke cycle engine.

\*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture and discussion  
Laboratory demonstration and practice

Suggested Resources:

Primary Resource: Hires, Bill; Taylor, Mark; and Bundy, Mike.  
Small Engine Repair: Two-Stroke and Four-Stroke Cycle. Stillwater, OK: Mid-America Vocational Curriculum Consortium. Revised by Ammon Herd. 1985.

Evaluation and Suggested Minimum Performance Standards:

- \*Objective 1: The student will match five terms related to the overhaul of two-stroke cycle engines with their correct definitions.
- \*Objective 2: The student will list five causes of two-stroke cycle engine problems.
- \*Objective 3: The student will identify six parts of the two-stroke cycle piston and connecting rod assembly.
- \*Objective 4: The student will identify three parts of the two-stroke cycle crankshaft assembly.
- \*Objective 5: The student will disassemble, inspect, service, and reassemble a two-stroke cycle engine following manufacturer's specifications and procedures.

\*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

- \_\_\_ \*1. Matched terms related to the overhaul of two-stroke cycle engines with their correct definitions.
- \_\_\_ \*2. Listed causes of two-stroke cycle engine problems.
- \_\_\_ \*3. Identified the parts of the two-stroke cycle piston and connecting rod assembly.
- \_\_\_ \*4. Identified the parts of the two-stroke cycle crankshaft assembly.
- \_\_\_ \*5. Disassembled, inspected, serviced, and reassembled a two-stroke cycle engine.

\*Indicates core/essential objectives

COURSE: Outboard Marine Engine Mechanics

Unit 11: Troubleshooting

Objectives: Upon completion of this unit, the student will:

- \*1. List requirements for an engine to run.
- \*2. List in order the steps in basic troubleshooting procedures.
- \*3. Troubleshoot the fuel system.
- \*4. Troubleshoot the ignition system.
- \*5. Troubleshoot engine compression.

\*Indicates core/essential objectives

Suggested Instructional Procedures:

Lecture and discussion  
Laboratory demonstration and practice

Suggested Resources:

Primary Resource: Hires, Bill; Taylor, Mark; and Bundy, Mike.  
Small Engine Repair: Two-Stroke and Four-Stroke Cycle. Stillwater, OK: Mid-America Vocational Curriculum Consortium. Revised by Ammon Herd. 1985.

Evaluation and Suggested Minimum Performance Standards:

- \*Objective 1: The student will list three requirements for an engine to run.
- \*Objective 2: The student will list in order five steps in basic troubleshooting procedures.
- \*Objective 3: The student will troubleshoot the fuel system according to industry accepted practices.
- \*Objective 4: The student will troubleshoot the ignition system according to industry accepted practices.
- \*Objective 5: The student will troubleshoot engine compression according to industry accepted practices.

\*Indicates core/essential objectives

Performance Record: Place a check by each objective the student achieved:

- ☐ \*1. Listed requirements for an engine to run.
- ☐ \*2. Listed in order the steps in basic troubleshooting procedures.
- ☐ \*3. Troubleshot the fuel system.
- ☐ \*4. Troubleshot the ignition system.
- ☐ \*5. Troubleshot engine compression.

\*Indicates core/essential objectives

STUDENT PERFORMANCE RECORD  
OUTBOARD MARINE ENGINE MECHANICS

## OUTBOARD MARINE ENGINE MECHANICS I

Student: \_\_\_\_\_

This record is provided as an alternative to the student performance records at the end of each unit. It can be duplicated for each student and serve as a cumulative record of competencies achieved in the course.

Place a check by each objective the student achieved; you may wish to note the date that the student achieved the objective.

C = Core competencies

- \_\_\_\_ 1. Matched terms associated with safety.
- \_\_\_\_ C2. Matched the colors of the safety code with their correct applications.
- \_\_\_\_ 3. Completed a list of steps for maintaining a safe and orderly shop.
- \_\_\_\_ C4. Matched the classes of fires with their correct descriptions.
- \_\_\_\_ C5. Distinguished between safe and unsafe shop practices.
- \_\_\_\_ C6. Listed general shop safety rules.
- \_\_\_\_ C7. Defined terms associated with hazardous materials.
- \_\_\_\_ C8. Identified categories of hazardous materials.
- \_\_\_\_ C9. Stated signal words or symbols that indicate how severe a hazard may be.
- \_\_\_\_ C10. Listed methods for reducing hazardous waste.
- \_\_\_\_ C11. Identified general procedures for storing hazardous materials and wastes.
- \_\_\_\_ C12. Identified and described the informational sections found on a Material Safety Data Sheet.
- \_\_\_\_ C13. Described general first aid procedures to follow in case of an accident involving hazardous materials.
- \_\_\_\_ C14. Identified safety equipment to be used with hazardous materials.
- \_\_\_\_ C15. Listed steps to follow in handling spills and waste disposal.
- \_\_\_\_ C16. Identified agencies to be contacted in case of an accident or for more information on hazardous materials.
- \_\_\_\_ C17. Listed safety measures to follow in working on boats with bilges.
- \_\_\_\_ C18. Identified basic hand tools needed for maintenance and repair of small engines.
- \_\_\_\_ C19. Identified the types of torque wrenches.
- \_\_\_\_ 20. Completed a list of statements concerning the maintenance procedures of hand tools.
- \_\_\_\_ 21. Identified common fasteners.
- \_\_\_\_ C22. Listed methods used to remove seized nuts.
- \_\_\_\_ 23. Identified tools used to restore internal and external threads.

- \_\_\_C24. Identified measuring instruments used in small engine repair.
- \_\_\_C25. Used a plain micrometer.
- \_\_\_C26. Used a vernier caliper.
- \_\_\_C27. Matched terms associated with engine identification and inspection.
- \_\_\_C28. Distinguished characteristics of four-stroke and two-stroke cycle engines.
- \_\_\_C29. Identified the operating positions of the crankshaft.
- \_\_\_C30. Matched terms associated with basic engine principles and design.
- \_\_\_C31. Matched the parts of a basic internal combustion engine cylinder unit with their correct descriptions.
- \_\_\_32. Completed a list of statements in the process by which an internal combustion engine converts chemical energy into rotary motion.
- \_\_\_C33. Matched terms associated with the principles of operation of a four-stroke cycle engine.
- \_\_\_C34. Identified basic components of a four-stroke cycle engine.
- \_\_\_35. Selected true statements concerning the operation of a four-stroke cycle engine.
- \_\_\_C36. Matched terms associated with the two-stroke cycle engine.
- \_\_\_C37. Identified basic components of a two-stroke cycle engine.
- \_\_\_38. Selected true statements concerning the operation of a two-stroke cycle engine.
- \_\_\_C39. Matched terms associated with air-cooled cooling systems.
- \_\_\_C40. Identified components of an air cooled engine cooling system.
- \_\_\_C41. Removed, cleaned, and replaced air cooling system parts.
- \_\_\_C42. Identified the parts of a water-cooled engine cooling system.
- \_\_\_C43. Inspected and serviced a water-cooled engine cooling system.
- \_\_\_C44. Matched terms associated with outboard fuel systems with their proper definitions.
- \_\_\_C45. Identified the parts of an outboard vacuum fuel system.
- \_\_\_C46. Identified the parts of a primer bulb of an outboard vacuum fuel system.
- \_\_\_C47. Matched terms associated with carburetion to their proper definitions.
- \_\_\_C48. Identified the parts of carburetor.
- \_\_\_C49. Selected possible carburetor problems.

## OUTBOARD MARINE ENGINE MECHANICS II

Student: \_\_\_\_\_

This record is provided as an alternative to the student performance records at the end of each unit. It can be duplicated for each student and serve as a cumulative record of competencies achieved in the course.

Place a check by each objective the student achieved; you may wish to note the date that the student achieved the objective.

C = Core competencies

- \_\_\_\_ 1. Matched terms associated with safety.
- \_\_\_\_ C2. Matched the colors of the safety code with their correct applications.
- \_\_\_\_ 3. Completed a list of steps for maintaining a safe and orderly shop.
- \_\_\_\_ C4. Matched the classes of fires with their correct descriptions.
- \_\_\_\_ C5. Distinguished between safe and unsafe shop practices.
- \_\_\_\_ C6. Listed general shop safety rules.
- \_\_\_\_ C7. Defined terms associated with hazardous materials.
- \_\_\_\_ C8. Identified categories of hazardous materials.
- \_\_\_\_ C9. Stated signal words or symbols that indicate how severe a hazard may be.
- \_\_\_\_ C10. Listed methods for reducing hazardous waste.
- \_\_\_\_ C11. Identified general procedures for storing hazardous materials and wastes.
- \_\_\_\_ C12. Identified and described the informational sections found on a Material Safety Data Sheet.
- \_\_\_\_ C13. Described general first aid procedures to follow in case of an accident involving hazardous materials.
- \_\_\_\_ C14. Identified safety equipment to be used with hazardous materials.
- \_\_\_\_ C15. Listed steps to follow in handling spills and waste disposal.
- \_\_\_\_ C16. Identified agencies to be contacted in case of an accident or for more information on hazardous materials.
- \_\_\_\_ C17. Identified the main parts of the mechanical remote control assembly.
- \_\_\_\_ C18. Disassembled and reassembled a mechanical remote control assembly.
- \_\_\_\_ C19. Installed and adjusted shift and throttle control cables.
- \_\_\_\_ C20. Matched terms related to tilt assemblies to their definitions.
- \_\_\_\_ 21. Distinguished between the types of tilt assemblies.
- \_\_\_\_ C22. Distinguished between types of hydraulic assemblies.
- \_\_\_\_ C23. Identified the parts of the hydraulic tilt and trim assembly.

- \_\_\_C24. Identified the parts of the manual tilt assembly.
- \_\_\_C25. Serviced a hydraulic tilt and trim assembly.
- \_\_\_C26. Matched terms associated with propellers and trim tabs to their proper definitions.
- \_\_\_C27. Identified parts of the propeller and trim tab.
- \_\_\_C28. Listed the common types of propellers.
- \_\_\_29. Selected kinds of materials used to make propellers.
- \_\_\_C30. Determined the correct propeller pitch for a given boat and motor.
- \_\_\_31. Completed a list of statements concerning the purposes of the trim tab.
- \_\_\_C32. Removed, inspected, and installed a propeller.
- \_\_\_C33. Removed, inspected, installed, and adjusted a trim tab.
- \_\_\_C34. Installed a slip clutch and shear pin
- \_\_\_C35. Matched terms related to the cooling system with their correct definitions.
- \_\_\_C36. Identified the parts of a cooling system.
- \_\_\_C37. Identified the parts of the exhaust housing.
- \_\_\_38. Selected true statements concerning the functions of the wet sleeve, exhaust relief, and exhaust housing.
- \_\_\_C39. Identified the parts of the water pump.
- \_\_\_40. Distinguished between impeller positions.
- \_\_\_C41. Selected true statements concerning the operation of a thermostat.
- \_\_\_C42. Completed statements concerning the operation of the cooling system.
- \_\_\_C43. Completed statements concerning troubleshooting the cooling system.
- \_\_\_C44. Removed, inspected, and installed a water pump.
- \_\_\_C45. Removed, inspected, and installed a thermostat.
- \_\_\_C46. Removed, inspected, and installed an exhaust housing.
- \_\_\_C47. Matched terms related to the mechanical gearcase with their proper definitions.
- \_\_\_C48. Identified the parts of a mechanical gearcase.
- \_\_\_C49. Matched the main parts of the mechanical gearcase with their purposes.
- \_\_\_C50. Disassembled, reassembled, and serviced a one-piece mechanical gearcase.
- \_\_\_C51. Disassembled, inspected, reassembled, and serviced a two-piece mechanical gearcase.
- \_\_\_C52. Listed fuel system problems which can cause an outboard to perform improperly.
- \_\_\_C53. Selected engine problems which are caused from an improper fuel supply.
- \_\_\_C54. Disassembled, serviced, and reassembled a vacuum fuel system.
- \_\_\_C55. Listed symptoms of poor carburetion.
- \_\_\_C56. Removed, disassembled, serviced, reassembled, and reinstalled a carburetor.
- \_\_\_C57. Stated the purpose of the ignition system.

- \_\_\_ 58. Identified parts of a Mercury belt driven, pointless, capacitor discharge system.
- \_\_\_ C59. Completed a schematic diagram of a magneto ignition system.
- \_\_\_ C60. Completed a troubleshooting chart for the ignition system.
- \_\_\_ C61. Disassembled, adjusted and/or repaired, and reassembled a magneto ignition system.
- \_\_\_ C62. Matched terms related to the overhaul of two-stroke cycle engines with their correct definitions.
- \_\_\_ C63. Listed causes of two-stroke cycle engine problems.
- \_\_\_ C64. Identified the parts of the two-stroke cycle piston and connecting rod assembly.
- \_\_\_ C65. Identified the parts of the two-stroke cycle crankshaft assembly.
- \_\_\_ C66. Disassembled, inspected, serviced, and reassembled a two-stroke cycle engine.
- \_\_\_ C67. Listed requirements for an engine to run.
- \_\_\_ C68. Listed in order the steps in basic troubleshooting procedures.
- \_\_\_ C69. Troubleshoot the fuel system.
- \_\_\_ C70. Troubleshoot the ignition system.
- \_\_\_ C71. Troubleshoot engine compression.